

## **PART 1. COVER PAGE**

Project Title: **Development of a GIS Level 1 Assessment Tool**

Amount of funds being requested from EPA: \$55,997 over two years

Name of organization applying for funds: Montana Natural Heritage Program of The Nature Conservancy

Name of primary contact for this pre-proposal: Linda Vance, Ph.D

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DUNS Number: 072656630

### **1. Please check the funding program you are applying for (please mark only one):**

- |  |   |
|--|---|
| <input type="checkbox"/> Tribal Source Water Protection                | <input type="checkbox"/> Source Reduction Assistance                    |
| <input checked="" type="checkbox"/> Wetlands Program Development Grant | <input type="checkbox"/> RGI/EPP for watershed project                  |
| <input type="checkbox"/> Strategic Agriculture Initiative              | <input type="checkbox"/> RGI/EPP for air toxics project                 |
| <input type="checkbox"/> TMDL  | <input type="checkbox"/> RGI/EPP for non-tribal source water protection |

### **2. Please check the type of agency or organization applying for funding:**

- ☒ Non-profit or community-based environmental organization (pass-through to Montana DEQ)

### **3. Please describe the geographic location of the project being proposed: Helena, MT**

### **4. Please check the Regional priority or priorities this proposal best supports?**

- ☐ Agriculture ☐ Energy
- ☒ Enhancing Capacity to Provide Public Health and Environmental Protection in Region 8 States and on Tribal Lands

### **5. Please list the Strategic Plan goals and objectives this proposal aligns with:**

4.3.1 Protect and Restore Ecosystems. 4.3.2: Increase Wetlands.

6. If you are applying for a funding program that requires a match, provide the amount of match being provided \$ 34,053 (match).

## **PART 2. GENERAL CRITERIA**

### **1) Project summary**

Montana is launching a three-year project to update and expand digital wetland mapping. Mapping efforts will focus on three watersheds with significant development pressures. While wetland managers and planners will find the maps to be a valuable resource, they will still need a way to assess wetland condition across broad areas of interest (e.g. counties, watersheds, valleys, etc). Montana is developing a rapid wetland assessment tool (DEQ 2005), and there are GIS-based tools for assessing watershed-level impacts that may have detrimental effects on wetlands (Daumiller 2003, Vance 2005), but there is no Level 1 assessment tool (Kentula 2005). We propose to fill this gap by creating a GIS-based Level 1 assessment tool that will enable wetland planners, managers, and restoration personnel to fully benefit from the new maps. We will use a bottom-up approach to develop the tool. We have site-specific wetland condition data from several intensive assessment projects in wetlands across the state, as well as hundreds of assessments carried out by our own staff and our state and federal partners. Using this data and standard GIS assessment approaches, we will identify the landscape-level factors that predict wetland condition, and determine the scale at which those factors have the most direct influence. From this analysis, we will develop a prototype GIS model that we will test and calibrate across the majority of ecological sections in the state. Once tested, the model will be used as the basis for a GIS tool/application that will be demonstrated and disseminated to state, tribal and local governments throughout the state, along with supporting documentation and manuals.

### **2) Activities to be conducted**

#### **a) Identify landscape-level assessment metrics that can be used with a GIS to produce reasonably accurate preliminary assessments of site-level wetland condition.**

Landscape-level impacts such as land use/cover, road density, water diversions, and resource extraction have site-level effects on wetlands (Johnson 2005). We will create a GIS model of those impacts, identifying the geographic scale (e.g. 100 meters, 50 meters, 1000 meters) at which they operate. Our model will incorporate GIS-based assessment metrics developed in other states (e.g. Tiner 2000, Kentula 2005) and in Montana (Daumiller 2003, Vance 2005), but will refine these metrics using a bottom-up iterative approach. Specifically, we will use site-level assessment data to select and weight the landscape-level factors that are indicative of wetland condition, using a classification and regression tree (CART) approach. The Montana Natural Heritage Program (MTNHP) has conducted intensive wetland site assessments in watersheds across the state, collecting data into a sites database. We have also compiled a description and analysis of high-quality reference wetlands from data collected by the Montana Field Office of The Nature Conservancy, university scientists, the plot database of the Riparian and Wetland Research Program at the School of Forestry, University of Montana, and U.S. Forest Service peatland inventories (Cooper and Jones 2003). Our partners at the Montana Department of Environmental Quality (DEQ) and the Bureau of Land Management (BLM) have carried out hundreds of rapid assessments of both lentic and lotic wetlands. These assessments and descriptions will be our “training data.” The goal of this task will be to produce a set of GIS-

derived landscape-level wetland metrics that can predict “high-quality,” “good,” or “poor” site condition in the training data with at least 75% accuracy. This will be our prototype model.

**b) Develop a probabilistic sampling strategy for model refinement.**

Wetlands respond in different ways to landscape-level impacts depending on basin position, vegetation, hydrologic regime, and site-level morphology. To capture this variability, we will design a probabilistic sampling scheme that incorporates a double stratification approach: first, by ecological section, and second, by wetland type, using a combination of Cowardin (1979) classes and hydrogeomorphic (Hauer et al. 2000) modifiers. From the six ecological sections with existing National Wetland Inventory (NWI) mapping (Flathead Valley, Northern Rockies, Rocky Mountain Front, Northwest Glaciated Plains, Bitterroot Valley and Belt Mountains), we will randomly select 24K USGS quadrangles, and use a GIS to query the quadrangles until we have at least twenty representatives of the 15 most prevalent unaltered wetland type in each ecological section (n=1800).

**c) Test and refine the model**

We will run the prototype model on the 1800 sample wetlands selected in task 2, classifying them into condition classes (e.g. high-quality, good, or poor). We will then randomly select 30 wetlands from each condition class in each ecological section. From this random selection, we will select 10 wetlands in each condition class in each ecological section based on land ownership and accessibility (n=180), and will examine recent orthophotos and National Agricultural Imagery Program (NAIP) color IR photos to ensure the wetland still exists. These 180 wetlands will be entered into a blind database (i.e., without scores), then will be field-assessed by a wetland ecologist, using a rapid assessment tool. Results of the GIS-based assessment and site-level assessment will be compared to determine the accuracy and sensitivity of individual parameters. Redundant or unnecessary metrics will then be dropped from the model. Results of the field assessment will be conveyed to Montana DEQ for inclusion in its wetland database. High-quality sites will be entered into the MTNHP plots database. Results of the assessment and model testing will be presented at the Montana Wetlands Council Fall meeting.

**d) Develop a Level 1 GIS tool that can be used by ArcMap users with no particular modeling skills to evaluate wetlands.**

The model will be incorporated into a GIS application or tool that can be widely disseminated to wetland planners, managers, and advocates throughout the state. The tool will run with datasets readily available from the Montana State Library’s Natural Resource Information System (NRIS), and will be accompanied by a manual explaining data requirements, procedures, limitations, and applications. We will demonstrate the tool at watershed and wetland meetings and symposia, and make it available for download from our website.

### **3) MEASUREMENT:**

#### **Outcomes:**

a) Governmental and non-governmental planners, managers and advocates in Montana will have a Level 1 assessment tool that will enable them to quickly evaluate wetland condition using existing digital datasets. This will:

- enhance State, local, and tribal capacity to develop regulatory frameworks, implement wetland protection programs, and target assessment and monitoring efforts towards especially vulnerable wetland resources;
- allow refinement of efforts towards ecosystem protection and prevention of net loss of wetlands;
- improve Montana's wetland knowledge base.

b.) Wetland program planners and managers at all levels of government in Montana will be able to analyze the distribution of wetland impacts across broad landscapes. This will

- increase their capacity to set program-wide mitigation objectives based on a science-based landscape-level wetland condition assessment;;
- allow them to identify high-priority regions based on wetland conditions, so that monitoring, conservation and acquisition efforts can be tailored to specific objectives;

c) Wetland scientists, planners, managers and other interested parties will have the ability to conduct broad preliminary wetland assessments so that assessment and monitoring budgets can be extended to a broader geographic area;

d) Watershed planners and regulators will have a Level 1 assessment tool to complement the Level 2 rapid assessment tool underdevelopment by Montana DEQ;

e) Wetland scientists, planners, managers and other interested parties in other Region 8 states will have a GIS model that has been tested in several ecological sections, providing a starting point for them to develop their own comparable models.

#### **Outputs:**

a) A report detailing the development of the tool including a) model development, sampling methodology, and statistical analysis; b) landscape level metrics that do and do not predict site-level wetland condition; and c) wetland condition assessments for the 180 wetlands where the model was tested and refined;

b) A probabilistic sampling methodology covering six of the nine ecological sections of Montana that will facilitate future wetland research;

c) A Level 1 GIS tool that can be used by ArcMap users with no particular modeling skills to conduct preliminary wetland condition assessments using existing datasets.

#### **4) PROGRAMMATIC CAPABILITY OF APPLICANT:**

The Natural Heritage Program is Montana's source for information on Montana's native species and habitats, emphasizing those of conservation concern. We collect, validate, and distribute this information, and assist natural resource managers and others in applying it effectively. Established by the Montana State Legislature in 1983, the program is located in the Montana State Library, where it is part of the Natural Resource Information System. The Montana Natural Heritage Program is part of the Natural Heritage Network, and our data are linked to similar programs in all 50 states, most Canadian provinces, and many Latin American countries. MTNHP staff includes eight professional (M.S./Ph.D) scientists, three assistant/support biologists, three data management staff, an information services manager, a web application developer, a finance and grants manager, an office assistant, and an executive director. Contractors and project support personnel are hired as necessary. The Natural Resource Information System (NRIS) maintains web-accessible datasets and data bundling applications allowing users to download watershed-specific ArcGIS shapefiles including but not limited to land use, roads, streams, wetlands, 404 permits, ownership, vegetation (GAP), and census data. Recent projects completed by MTNHP staff include:

- Watershed Assessment of the Whitewater and Cottonwood Watersheds, September 2005 (BLM)
- A Vegetation Index of Biotic Integrity for Small-order Streams in Southwest Montana and a Floristic Quality Assessment for Western Montana Wetlands, July 2005 (EPA/DEQ)
- Ecologically Significant Wetlands in the Missouri Headwaters: Jefferson, Lower Madison, Lower Gallatin, and Upper Red Rock River Watersheds, June 2004 (EPA/DEQ)
- Using Vegetation to Assess Wetland Condition: a multimetric approach for temporarily and seasonally flooded depressional wetlands and herbaceous-dominated intermittent and ephemeral riverine wetlands in the northwestern glaciated plains ecoregion, Montana, February 2004 (EPA/DEQ)
- Wetland Assessment of the Whitewater Watershed, November 2003
- Site Descriptions of High-Quality Wetlands Derived from Existing Literature Sources, June 2003

All completed projects can be found on our website at <http://mtnhp.org/reports.asp>. Beginning in January, we will begin work with the Montana DEQ to digitize existing NWI maps, create new digital maps of pilot watersheds, and implement a change detection analysis pursuant to an EPA Wetland Demonstration Program Pilot Grant (WDP). All our contracts are overseen by project or program managers, and a project tracking system ensures that reports and other deliverables are submitted in a timely manner. We have expertise and equipment for field studies and data collection, digitizing, image processing and analysis, GIS analysis, mapping, database creation and maintenance, report publication and web hosting.

## **5) PROJECT DOES NOT DUPLICATE EFFORTS ALREADY BEING DONE.**

To the best of our knowledge, there is no other Level 1 assessment tool being developed for the ecological sections found in Montana. We have created and refined a watershed-level assessment model, but it is not precise enough to predict site-specific wetland condition, only overall watershed health (Vance 2005). A GIS-based wetland assessment tool developed by Daumiller (2003) used an ArcView 3.3 graphical interface to assign user-determined weights to various watershed-level wetland stressors, but it also operated at too gross a scale to be an effective predictor of wetland condition. Neither model is undergoing any further refinement at this time.

## **6) PROJECT PARTNERS:**

### **a). Montana Department of Environmental Quality**

The Montana Natural Heritage program works closely with the Montana Department of Environmental Quality to ensure that projects are completed on time and in a manner that promotes the goals of the state's Wetland Program. Maps, GIS layers, models and final reports will be used by the DEQ to meet objectives in the Draft Conservation Strategy for Montana Wetlands. The funds applied for will be administered by the DEQ.

### **b). Montana State Library Natural Resource Information System (NRIS)**

The Montana Natural Heritage is part of the State Library's Natural Resource Information System, operated contractually through a 20-year public/private partnership with The Nature Conservancy. The State Library and NRIS provides office space, technical, database, network, and web hosting services, and through funding from the State Legislature, supports the core functions of the Natural Heritage Program. All matching funds for this project are from this source (see the budget page, below). The model and data sources will be available for download at the MTNHP/NRIS website when complete.

## **PART 3: PROGRAM CRITERIA**

The overall goal of this project is to further the development of regulatory and non-regulatory wetland programs in Montana by creating a tool that will enable wetland planners and resource managers to conduct rapid GIS-based wetland condition assessments using existing datasets. The tool developed as part of this project will also have region-wide benefits insofar as it demonstrates an innovative, cost-effective approach to wetland assessment, thus making efficient use of limited resources and budgets.

The project meets the specific criteria set down for Wetland Program Development Grants as follows:

### **1. The project strengthens State or Tribal comprehensive wetland programs.**

Montana's state and tribal wetland managers lack the budget and resources to conduct the number of site-level assessments that are needed to develop comprehensive wetland programs. By developing a science-based, user-friendly GIS tool capable of delivering Level 1 assessments

with a reasonable degree of precision and accuracy, this project will enhance programmatic capacity to evaluate wetland condition, and to devise geographically-focused wetland protection strategies, including conservation, acquisition, and mitigation projects.

## **2. The project contributes to the direct protection of wetlands**

The GIS tool will enable wetland managers and planners to assess both high-quality wetland areas that are candidates for conservation easements or acquisition and areas in need of focused evaluation, monitoring, protection, or mitigation.

## **3. The project is consistent with government wetlands conservation priorities or strategies**

Montana's Draft Conservation Strategy lists five goals/objectives: 1) Improving the wetlands knowledge base; 2) Encouraging voluntary conservation on private land; 3) Enhancing conservation on public land; 4) Providing resources: information and education, technical assistance and funding; and 5) Improving regulatory program effectiveness. This project will

- Improve the wetlands knowledge base by identifying the landscape-level metrics that best predict wetland condition;
- Encourage voluntary conservation on private land by providing land owners and managers with a tool that demonstrates the links between land use practices and wetland condition, and allows them to model alternatives;;
- Enhance conservation on public land by providing managers with maps and models to use in planning, assessment and mitigation;
- Provide information, tools, and educational resources that can be accessed free of charge from the MTNHP/NRIS website;
- Improve regulatory program effectiveness by providing managers with a science-based tool for conducting wetland assessments using existing data sources

## **4. The project refines the protection of vulnerable wetlands and aquatic resources**

Montana resource managers and planners do not have a statistically robust assessment tool for rapidly evaluating wetland condition from existing data sources, nor do we have conclusive correlations between landscape-level metrics and wetland condition to guide land managers. By filling this gap, the project will allow planners, resource managers, and private conservation organizations to identify, assess, and prioritize vulnerable wetlands for protection, acquisition, or restoration.

## **5. The project contributes to the development of a comprehensive monitoring and assessment program.**

By providing a user-friendly first-cut wetland assessment tool, the project will enable wetland resource managers and planners to conduct initial wetland assessments, and direct detailed assessment and monitoring resources to sites that have already undergone screening. Similarly, by linking landscape-based metrics to wetland condition, it will enable managers and planners to target areas with high levels of identified landscape stressors for further evaluation and analysis.

## **6. The project improves the effectiveness of compensatory mitigation.**

MTNHP is currently working on an EPA-funded project to create a GIS-based algorithm for assigning HGM types to wetlands. If successful, that tool will allow users to evaluate potential wetland values and functions across broad geographic areas. By providing users with a tool to assess wetland condition, this project will give users the means to determine whether a given wetland actually can be expected to deliver those values and functions. With this level of detail, managers and planners will be able to devise effective mitigation strategies, based on a knowledge of resources and resource needs in the area..

## **PART 4: PROJECT TIMELINE AND DELIVERABLES**

### **a) Identify landscape-level assessment metrics that can be used with a GIS to produce reasonably accurate preliminary assessments of site-level wetland condition**

*Start date:* 11/01/2006

*Completion date:* 04/15/2007

*Deliverables:* A prototype assessment model with results of the analysis linking landscape metrics to wetland condition.

### **b) Develop a probabilistic sampling strategy for model refinement**

*Start date:* 04/15/2007

*Completion date:* 05/15/2007

*Deliverables:* A written summary of the sampling scheme

### **c) Test, refine, and promote the model**

*Start date:* 05/15/2007

*Completion date:* 10/15/2007

*Deliverables:* Data from field-based rapid assessments (n=120) will be transmitted to Montana DEQ in electronic format for entry into their database. High-quality wetlands will be entered into MTNHP plots database. Results will be presented to Montana Wetlands Council at Fall meeting.

### **d) Develop a Level 1 GIS tool that can be used by ArcMap users with no particular modeling skills to evaluate wetlands.**

*Start date:* 10/16/2007

*Completion date:* 04/15/08

*Deliverables:* Final report on project; model and supporting documentation posted to MTNHP/NRIS website for download.



## PART 5. BUDGET

	Request	Match	Total cost
<b>Personnel</b>			
Science Staff (Professional and support)	\$27,000		\$27,000
Information Management Staff		\$6,000	\$6,000
Director and Program Oversight, including Finance		\$6,912	\$6,912
Fringe at 40% of salaries	\$10,800	\$5,165	\$15,965
<b>PERSONNEL TOTAL:</b>	<b>\$37,800</b>	<b>\$18,077</b>	<b>\$55,877</b>
<b>Fieldwork and travel</b>			
Mileage and per diem (5000 miles, 30 days)	\$4,050		\$4,050
<b>Supplies and equipment</b>			
Project supplies	\$100		
General equipment and supplies		\$2,794	\$2,794
<b>Fees and expenses</b>			
Phone and internet charges (including phone cards)	\$300		
Report printing, GIS duplication	\$600		
Project training, software licenses, etc	\$1,000		
General staff training (field staff, professional development)	\$1,676		
<b>NON-PERSONNEL TOTAL:</b>	<b>\$7,726</b>	<b>\$2,794</b>	<b>\$10,520</b>
<b>TOTAL EXPENSES:</b>	<b>\$45,526</b>	<b>\$20,871</b>	<b>\$66,397</b>
<b>INDIRECT COSTS (23%)</b>	<b>\$10,471</b>	<b>\$4,800</b>	<b>\$15,271</b>
Montana State Library contributed support (15% of personnel)		\$8,382	\$8,382
<b>TOTAL PROJECT COST</b>			<b>\$90,050</b>
<b>TOTAL REQUESTED FROM EPA</b>	<b>\$55,997</b>		
<b>NON-FEDERAL MATCH:</b>		<b>\$34,053</b>	

## REFERENCES:

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Cowardin L.M., V. Carter, F.C. Golet and E.T LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. USFWS, Office of Biol. Ser. (FWS/OBS-79/31), December 1979. 103 pp

Daumiller, G. 2003. GIS Landscape Assessment Tool. Montana Wetland Monitoring and Assessment Meeting. Missoula, MT, October 7, 2003. Available at:  
<http://deq.mt.gov/wqinfo/Wetlands/NRISwshedAssess.pdf>

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Kentula, M. 2005. Applications of The Three Level Approach For Wetland Monitoring and Assessment. Presented at EPA Region VIII State and Tribal Wetland Meeting, Golden. CO, October 27, 2005.

Tiner, R. W., M. Starr, H. Bergquist, and J. Swords. 2000. Watershed-based Wetland Characterization for Maryland's Nanticoke River and Coastal Bays Watersheds: A Preliminary Assessment Report. U.S. Fish & Wildlife Service, National Wetlands Inventory (NWI) Program, Northeast Region, Hadley, MA.

Vance, L.K. 2005. Watershed Assessment of the Whitewater and Cottonwood Watersheds. Report to the Bureau of Land Management. Montana Natural Heritage Program, Helena, MT.